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In-lake processing of DOM influences DOM lability and could reduce bioavailability of Hg

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Aquatic dissolved organic matter (DOM) influence lake water quality through processes such as light absorption, biological activity, and transport of pollutants. The quality of the DOM (e.g. size, aromaticity, biodegradability, etc.) will determine the impact of such processes. Currently, boreal surface waters are experiencing a browning effect, i.e. higher DOM, but little is known about changes in DOM quality. Mercury is a pollutant that is tightly linked to DOM, and thus mercury levels in lakes and aquatic food webs are expected to be influenced by changes in DOM dynamics.

The aim of this study was to investigate transformation processes of DOM in a dystrophic boreal headwater lake in southern Norway to better understand the in-lake processes governing water quality. This has been done by seasonal characterization of DOM from the lake inflow, hypolimnion, and outflow using a combination of novel and traditional techniques: Tangential flow filtration was used to produce two different size fractions of the DOM (LMW: < 0.01um and HMW: 0.01-0.2um), on which the initial biodegradability (24 h) was assessed using online oxygen measurements. Moreover, the different size fractions were characterized using fluorescence-absorption spectroscopy and analysed for mercury levels.

Preliminary results show that more than 85% of the DOM in this dystrophic lake was of larger molecular size, reflecting a high input of terrestrial organic material and thereby contrasting smaller DOM found e.g. in large drinking water reservoirs. The DOM from the inflow was generally of larger size than the DOM from both the outflow and the hypolimnion, indicating in-lake degradation of the DOM (photooxidation and/or biodegradation). In general, the smaller sized DOM fraction was found to be of higher relative biodegradability and of lower aromaticity and complexity when compared to the larger sized fraction. Photodegradation might be key to rendering terrestrial DOM more suitable for microbial processing. Interestingly, most of the mercury was found in the high molecular weight and less biodegradable DOM fraction, suggesting that DOM quality impacts uptake of mercury in food-webs.